## Outdated, Inaccurate Technology Undermines Pennsylvania Broadband Report

Bringing broadband service to Pennsylvanians in unserved communities is a vital goal. To achieve this end, we need to start with an accurate, scientific understanding of where broadband exists today. A recent report by the Center for Rural Pennsylvania is a big step in the wrong direction.

## Broadband Availability, Adoption, and Speed – Related but Different

The report, "Broadband Availability and Access in Rural Pennsylvania," purports to show the availability of broadband Internet access in Pennsylvania. Unfortunately, the report conflates availability and adoption and then uses results from a flawed speed test to further confuse matters. Put simply, broadband is *available* if a person can purchase the service from a cable, telecommunications, wireless, or other provider. A person has *adopted* broadband if they actually purchase the service.

- Availability Broadband service needs to be available or it cannot be adopted. We know from our own extensive research of the Pennsylvania broadband marketplace, that the large majority of Pennsylvanians have broadband access as a result of cable companies having launched a private capital investment of more than \$10 billion to build out robust Internet service throughout the Commonwealth. Pennsylvania has over 85,000 miles of high-speed cable plant. Our robust, fiber rich plant connects cities, townships, boroughs and rural areas, providing High Speed Internet to over 7.5 Million Pennsylvanians. However, while cable offers broadband service to most Pennsylvanians, and telco and wireless providers offer services to many more, there are still people to whom broadband is unavailable. That is why most policy makers, focused on using limited resources to get broadband to unserved areas, have been focused on improved mapping. There is a general recognition that the maps generated by the FCC can be improved, and NCTA - the Internet and Television Association has proposed a more precise method to identify unserved areas in Pennsylvania and around the country. The NCTA proposal can be found at https://ecfsapi.fcc.gov/file/10301202880115/022819%2011-10%20NCTA%20ex%20parte%20-%20477.pdf
- Adoption Once broadband is available, customers that choose to purchase the service generally have choices about the speed to which they can subscribe. It is important to recognize that the Internet speed a customer chooses to purchase is not the same as the level of service available to them. More than 95 percent of the 5 million homes in Pennsylvania have cable broadband access, and nearly 99 percent of those residences are offered Internet speeds of up to 1 Gigabit. However, many customers choose to purchase service tiers that are slower than the fastest service available in their area. For example, a person could choose to buy a 10 mbps service because it is sufficient to meet their needs, even if a 25 mbps service is available. To be clear, broadband is available to these people and they have adopted the service, but they might buy less than the currently defined FCC definition for so-called advanced telecommunications capability (i.e., 25 mpbs).

Speed Tests – Speed tests can provide helpful information. They can indicate the level of service being received by a person that has adopted broadband. However, speed tests are of limited help when identifying where broadband is available. For example, a person that has chosen not to buy broadband, despite having broadband available in their area, will be shown as not having access to broadband at all. Likewise, performing a speed test with a person who purchases the lowest tier of service available in an area does not indicate that higher speeds are unavailable in that area. It shows only that the test subject chose to adopt a certain tier of service. The "Broadband Availability and Access in Rural Pennsylvania" study makes this mistake. It maps speeds adopted by test participants and misrepresents those speeds as an indication of broadband availability. Even if the report accurately characterized what it intended to measure – broadband speeds – it would still be misleading. This is because the Report relies on an Internet speed measurement tool that has been proven to be unsuited for measuring broadband speeds. As a result, the report is highly misleading, overstating the number of homes without broadband and diverting attention away from the truly unserved parts of Pennsylvania.

The Problem with Test in the "Broadband Availability and Access in Rural Pennsylvania" study The Center for Rural Pennsylvania report relies heavily on the Network Diagnostic Test (NDT), a test which was not designed for measuring broadband speeds and which is incapable of accurately doing so. This was highlighted in a recent technical paper [https://arxiv.org/abs/1905.02334] as well as in prior research, including this study by researchers at MIT [https://groups.csail.mit.edu/ana/Publications/Understanding\_broadband\_speed\_measureme

nts bauer clark lehr TPRC 2010.pdf]. As a result, speeds across Pennsylvania were underreported by the Report, also creating the report's misleading findings about access.

NDT data is a bad measure of network speeds in part because it is so heavily influenced by what is going on in the homes where the measurements are taken (e.g., bad Wi-Fi signals, older equipment, etc.). What is important is measuring the speed that is reaching those homes.

The best way to accurately measure the capacity of a broadband connection is to use multiple parallel connections to determine the maximum available capacity to the home. The most accurate systems go further, to use dedicated hardware or embedded software, so that WIFI and user-related factors do not impinge on results and the most accurate measurement of speed is captured. Examples of effective testing models are included in the technical paper mentioned above.

In contrast, the NDT measurement – and as confirmed by the report's authors - is by design NOT able to measure actual or potential broadband speeds (aggregate capacity) but merely the potential speed of a \*single\* TCP connection. Given that each web page will require multiple parallel connections and a home may have dozens or more connections open at the same time (e.g., several each to Amazon, Facebook, Apple, Spotify, Netflix, Google, etc.) measuring single connection performance is largely irrelevant as a general matter and is completely irrelevant to measuring broadband speeds. To equate NDT results to a speed test in any fashion is

misleading and does a grave disservice to the report's stated goal of connecting the unserved in Pennsylvania.

In addition to the flaw of using a single connection for testing, NDT suffers from many other flaws, ranging from relying on WIFI, dependencies on outdated user devices, and running when the connection is being used by others in the home (e.g. Netflix.). Where the servers are located also matters - because sending data to a distant server will result in lower reported speeds. There are no M-Lab servers located in Pennsylvania [https://www.measurementlab.net/status/] – the closest ones are New York City and Dulles, VA. In contrast, the leading consumer speed test, speedtest.net (operated by Ookla), maintains 25 servers in Pennsylvania and over 7,900 globally.

To illustrate this, consider that the report claims that the median download speed in Centre County is a meager 6.8 Mbps. In contrast, Ookla's data for the same county records a median download speed of 71 Mbps – which is more than ten times higher than NDT's measurements. Ookla also can be negatively influenced by the same user factors as NDT but the key difference is that they use multiple TCP steams and have servers located within Pennsylvania, among technical differences.

This is illustrated in the contrasting images of NDT's broadband map and Ookla's





## Conclusion

Measuring broadband availability and broadband adoption are both important goals. Accurate speed tests are also important for showing that consumers can attain the speeds to which they have subscribed. It is important, however, that we do not, as the Pennsylvania Report has done, characterize speed tests as representing broadband availability. This would be true even in the case of a speed test based on a more accurate methodology. Expanding broadband to unserved areas is an essential goal, but any successful effort to do so must be based on a real, technically grounded understanding of the current broadband marketplace.